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### **Far Infrared Spectra of SiC--Moissanite**

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**Introduction:** Diamond anvil cells (DACs) have been used for the past several decades to generate very high static pressures: in these devices, pressures of 100 GPa are reasonably routine, and pressures in excess of 400 GPa have been achieved. Diamonds possess many qualities that make them nearly ideal for a wide range of high-pressure applications: unsurpassed hardness and bulk modulus, chemical inertness, high thermal conductivity, and broad x-ray and optical transparency. However, there is strong motivation to find alternatives to diamond anvils for some applications due to: 1) their extremely high cost (which scales exponentially with size), 2) their susceptibility to oxidation above 1000 K in air, and 3) regions of the electromagnetic spectrum for which they are unsuitable as windows. Anvils made of SiC-moissanite single crystals have been recently used to generate static pressures exceeding 50 GPa (MACs), and their utility for high-pressure x-ray diffraction and Raman measurements has been clearly demonstrated (Xu and Mao 2000). Moissanite is known to be exceptionally hard, and has significant benefits relative to diamond. These include resistance to oxidation at high temperatures, substantially lower cost, and the availability of large anvils – 300 carat moissanite anvils are available. Here we assess the utility of such anvils for high-pressure far infrared (FIR) spectroscopic measurements.

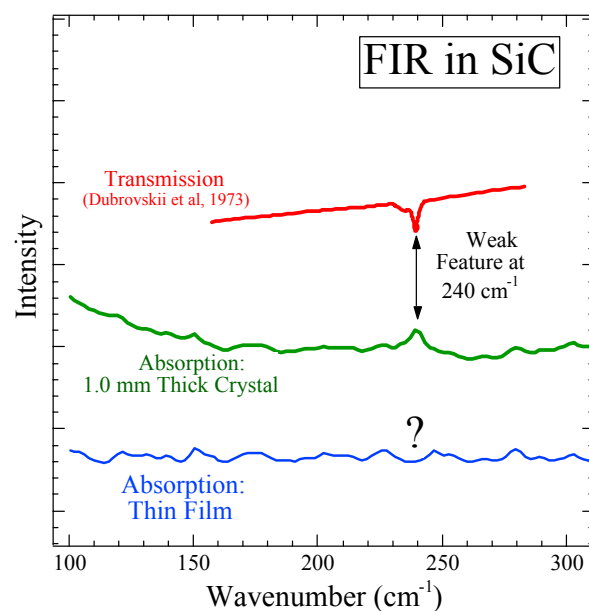
**Methods and Materials:** We used a single crystal of the hexagonal 6H polytype of SiC (moissanite) for these measurements. This is the same anvil material that was used in the study of Xu and Mao (2000). For comparison, we also analyzed a very fine-grained sample of 6H SiC from Alfa Aesar; we measured x-ray and mid infrared (MIR) spectra for both starting materials and found them to produce identical results. For thin-film measurements we crushed a single crystal of moissanite between two diamond anvils.

**Results:** Figure 1 shows our FIR spectroscopic results on both a thin film and for an approximately 1mm thick single crystal. A previous study (Dubrovskii and Radovanova 1973) described two closely spaced spectral features near  $240\text{ cm}^{-1}$ . However, the thickness of the sample of that study is not known; the motivation of the current study was to see if absorption in the FIR would reduce the utility of MACs for high-pressure spectroscopic studies in this frequency range. As can be seen from Figure 1, the absorption near  $240\text{ cm}^{-1}$  is not resolved in the thin film measurement. We find that even with a 1mm thick single crystal this feature appears with very low intensity, although the position agrees very well with the results of Dubrovskii and Radovanova (1973).

**Conclusions:** Although SiC-moissanite exhibits absorption in the FIR, the intensity of this band too low to cause substantial interference with FIR measurements. We conclude that anvils made of SiC-moissanite will work very well for conducting high-pressure measurements in this spectral region.

### **References:**

Xu, J. and Mao, H. K., "Moissanite: A window for high-pressure experiments", *Science*, **27**, 783-785, 2000.  
Dubrovskii, G. G. and Radovanova, E. I., "Additional lattice absorption bands in SiC polytypes", *Soviet Physics—Solid State*, **14**, 2127-2128, 1973.



**Figure 1.** FIR spectra of SiC-moissanite as both a thin film and a single crystal. For comparison, the transmission spectrum of a previous study (Dubrovskii and Radovanova 1973) is also shown. The absorption feature at  $\sim 240 \text{ cm}^{-1}$  is very low intensity, and we do not anticipate that it will interfere with high-pressure spectroscopic measurements conducted in MACs.